

## Section 3.4 - Predictions & Lines: $y = mx + b$

| Curriculum Outcomes   | Related Activities   | Page in Text |
|---|--|--------------|
| <ul style="list-style-type: none"> <li>determine the slope and y-intercept of a line from a table of values</li> </ul>  | <ul style="list-style-type: none"> <li>an investigation explores the connection between the values of <math>m</math> and <math>b</math> in an equation, the graph of the equation, and the original situation</li> </ul> | 118          |
| <ul style="list-style-type: none"> <li>determine the equation of a line using the slope and y-intercept</li> </ul>  | <ul style="list-style-type: none"> <li>a Focus shows the connection between the graph, equation, and the <math>m</math> and <math>b</math> and demonstrates how slope can be found and why it is important</li> </ul>    | 117          |
| <ul style="list-style-type: none"> <li>rearrange equations</li> </ul>   | <ul style="list-style-type: none"> <li>students solve problems using the skills they have learned with writing equations in the form <math>y = mx + b</math></li> </ul>  | 122          |
|   | <ul style="list-style-type: none"> <li>students investigate how to find equations of straight lines from limited information and use the equations to solve problems</li> </ul>  | 126          |
| <ul style="list-style-type: none"> <li>graph by constructing a table of values, by using graphing technology, and when appropriate by intercept-slope method</li> </ul> | <ul style="list-style-type: none"> <li>students rearrange equations and formulas in order to graph the equation of enter formulas into a spreadsheet.</li> </ul>   | 128          |

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- The equations we have been dealing with are linear equations or **equations of lines**.
- Equations of lines can be written in  **$y = mx + b$  format** or **slope y-intercept form** which is also known as **standard form**.
- To be able to determine the equation of a line we need 2 things:
  - a **slope**
  - a **point on the line**

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# SLOPE:

- the steepness of a line
- in equation form it is the coefficient of the variable  $x$ .
- in the format  $y = mx + b$        $m = \text{slope}$



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## Types of Slopes:

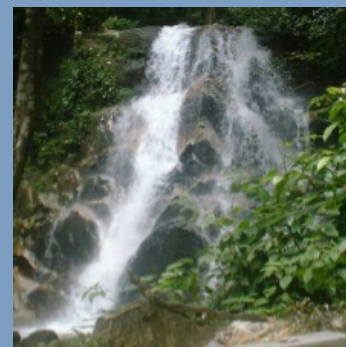
### Slope

Positive

Negative

Undefined





Zero



Oct 29-8:19 PM

# Steepness of Slopes:

## Examples of Slopes for Steepness

|   |   |  |   |
|---|---|--|---|
|  |  |  |  |
| Not Steep<br>Slope = 0.1  | A Little Steeper<br>Slope = 1   | Even Steeper<br>Slope = 2  | Very Steep<br>Slope = 4   |

Small slope

Large slope


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## How to Find Slope:

① From the equation  $y = mx + b$

the number found  
where the "m" is

### Examples:

1.  $y = -2x + 3$   


$m = -2$

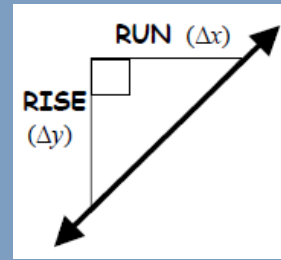
2.  $y = \frac{1}{3}x - 2$

$m = \frac{1}{3}$

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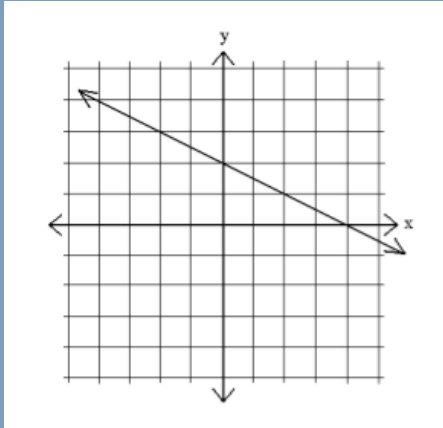
2

From a graph using rise  
run

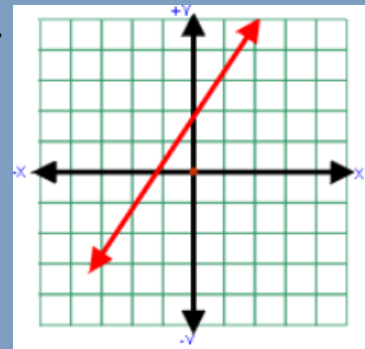


Examples:

1.



2.



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3

From 2 co-ordinate points

$$m = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow \begin{array}{l} y \text{ being the 2nd number in a co-ordinate } (x, y) \\ x \text{ being the 1st number in a co-ordinate } (x, y) \end{array}$$

Examples:

1.  $(2, 7)$  &  $(5, 1)$       2.  $(-2, 5)$  &  $(-5, 5)$

$x_1, y_1$        $x_2, y_2$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 7}{5 - 2} = \frac{-6}{3} = -2$$

$$\frac{5 - 5}{-5 - (-2)} = \frac{0}{-3}$$

zero

undefined  
 $\frac{0}{3} =$

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Pg. 129 # 2, 3 show work for #2

2. a.  $(1, 1)$   $(4, 3)$   
 $x_1, y_1$   $x_2, y_2$  Take out  
 $\frac{3-1}{4-1} = \frac{2}{3}$   $m = \frac{2}{3}$

2. e.  $(5, 3)$   $(7, 3)$   
 $x_1, y_1$   $x_2, y_2$   $m = \frac{y_2 - y_1}{x_2 - x_1}$   
slope  $\frac{3-3}{5-7} = \frac{0}{-2}$   $m = 0$

h.  $(2, -3)$   $(0, 4)$   
 $x_1, y_1$   $x_2, y_2$   
 $\frac{4 - (-3)}{0 - 2} = \frac{7}{-2}$   $m = -3.5$

3. g.  $(0.5, 3)$   $(2, -3)$   
 $x_1, y_1$   $x_2, y_2$   
 $\frac{-3 - 3}{2 - 0.5} = \frac{-6}{1.5} = -4$   $m = -4$

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## Practice:

State what the slope is for each of the following questions:

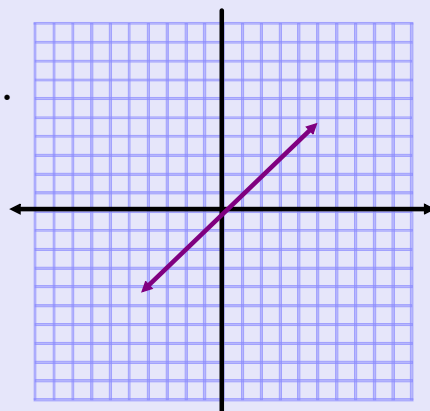
1.  $y = -2/3x + 2$

$$m = -2/3$$

3.  $(1, 4)$   $(-8, -7)$

$$\frac{-7 - 4}{-8 - 1} =$$

2.



Nov 9-12:27 PM

Pg. 129 Show your work for #2

#2,3

For example:

#2a.  $(1,1)$   $(4,3)$   $\swarrow$   
 $x_1, y_1$   $x_2, y_2$

$m = \frac{3-1}{4-1} = \frac{2}{3}$   $(m = \frac{2}{3})$

slope (m)  $m = \frac{y_2 - y_1}{x_2 - x_1}$

2.f.  $(-3,4)$   $(5,-2)$   
 $x_1, y_1$   $x_2, y_2$

$\frac{-2-4}{5-(-3)} = \frac{-6}{8}$   $m = \frac{-6}{8}$   
 $m = -0.75$

$\frac{4-0-2}{-3-5} = \frac{6}{-8}$   $(m = \frac{-6}{8})$

g.  $(-3,-1)$   $(-5,7)$

$\frac{-1-7}{-3-(-5)} = \frac{-8}{+2}$   $(m = -4)$

3i.  $(2\frac{1}{5}, -3)$   $(-3\frac{1}{2}, \frac{1}{2})$   
 $(2.2, -3)$   $(-3.5, 0.5)$   
 $x_1, y_1$   $x_2, y_2$

$\frac{0.5-(-3)}{-3.5-2.2} = \frac{3.5}{-5.7}$   $(m = -0.61)$

Nov 12-9:23 AM

Rearranging Equations into the form  $y = mx + b$

Example  $2y + 4 = 7x$  slope  $\uparrow$   $y$ -int.  $\uparrow$

$2y = 7x - 4$   
 $\frac{2y}{2} = \frac{7x - 4}{2}$   
 $y = 3.5x + 2$   
 $m = 3.5$   $y$ -int.  $= 2$

$3x = 2y - 4$   $y = mx + b$

$2y + 4 = 3x$

$\frac{2y}{2} = \frac{3x - 4}{2}$   $m = 1.5$   
 $y = 1.5x + 2$   $y$ -int.  $= 2$

Pg. 132 #1

Copy + Complete - Rearrange

Ⓐ  $5x + 3y = 7$  Ⓒ  $5x + 3y = 7$   
 $-5x$   $-5x$   
 $3y = -5x + 7$   
 $\frac{3y}{3} = \frac{-5x + 7}{3}$   
 $y = -1.6x + 2.3$

Ⓓ  $4x = 3 - 5y$  Ⓔ  $5y = 2 - 3x$   
 $-5y = -4x + 3$   $\frac{5y}{5} = \frac{-3x + 2}{5}$   
 $-\frac{5y}{5} = \frac{-4x + 3}{-5}$   $y = -0.6x + 0.4$   
 $y = 0.8x + 0.6$

Ⓢ  $5 = 3y - 4x$  Ⓡ  $0 = 2 - 3y + 4x$   
 $3y - 4x = 5$   $+3y$   $+3y$   
 $3y = 4x + 5$   $3y = 2 + 4x$   
 $\frac{3y}{3} = \frac{4x + 5}{3}$   $\frac{3y}{3} = \frac{4x + 2}{3}$   
 $y = 1.3x + 1.6$   $y = 1.3x + 0.6$

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Pg. 132 #1 Rearranging Equations into the form  $y = mx + b$

slope  $\uparrow$  y-int.  $\uparrow$

(d)  $7x + 2 = -3y$   
 $-3y = \frac{7x + 2}{-3}$   
 $y = -2\frac{1}{3}x - \frac{2}{3}$

(k)  $0 = 2 - 3y + 4x$   
 $+3y \quad +3y$   
 $3y = 2 + 4x$   
 $y = \frac{2}{3} + \frac{4}{3}x$   
 $y = \frac{4}{3}x + \frac{2}{3}$

$y = mx + b$

(h)  $3x - 4y = 0$   
 $-3x \quad +3x$   
 $-4y = -3x$   
 $y = \frac{3}{4}x$

$y = \frac{m}{4}x + 0$

Nov 13-3:00 PM

Pg. 117 - Focus 6

→ you will learn how an equation ( $y = mx + b$ ) relates to a graph

Slope - means "rate"

- growth rate  
 - speed  
 - \$/hr

Example:

- speed  
 (m/s)  
 (cm/hr)

y-int. = 20

$y = mx + b$   
 $y = mx + 20$

slope?  $m = \frac{y_2 - y_1}{x_2 - x_1}$

(0, 20)  
 (10, 40)

$m = \frac{40 - 20}{10 - 0}$   
 $m = \frac{20}{10}$   
 $m = 2$

$y = 2x + 20$

base fee = 20  
 hourly rate = \$2/hr.

Pg

Nov 14-1:48 PM

# Pg. 118 Investigation 5

A, B, C #1-4

$$y = mx + b$$

$\uparrow$        $\uparrow$

( , ) ( , )

$$m =$$

$$y\text{-int} =$$

$$y = \text{---} x + \text{---}$$

Nov 14-1:48 PM

Pg. 117       $m = \frac{y_2 - y_1}{x_2 - x_1}$       2 points

Any

y-axis: \$  
x-axis: hr.

$\frac{\$}{\text{hr}}$        $\frac{\$}{\text{hr}}$

Slope  $\rightarrow$  "Rate"

dist. (km)  
time (hr)

$y = 3x + 24$

Slope  $\frac{y}{x}$   
 $\hookrightarrow$  dist per km/hr.

km/hr 3 km/hr

Pg. 121 #11 "Rate" units?  
\$/day #12 \$/hr.

\$5 per hour to rent a crappy car and a basic rental fee of \$100

$y = 5x + 100$        $y\text{-int} = 5$        $m = 2$   
 $\uparrow$  slope = 5\$/hr

y-int: 100  $\rightarrow$  (0, 100)

Slope 5

Nov 14-9:15 AM



pg. 117

- y-int. is 20
- slope (m)  $m = \frac{y_2 - y_1}{x_2 - x_1}$   $\begin{matrix} (10, 40) \\ (20, 60) \end{matrix}$ 

$$= \frac{60 - 40}{20 - 10} = \frac{20}{10} = 2$$

$$m = 2$$
- Eqn. of the line:  $y = mx + b$

5 hours of use:

$$y = 2(5) + 20$$

$$y = 10 + 20$$

$$y = 30$$

\$2/hr 20 fee

It costs \$30 for 5 hrs. of use.

$$y = mx + b$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

"rate" means slope

"basic fee" means y-int.

Nov 14-9:31 AM

## Connecting Equations & Graphs of Lines:

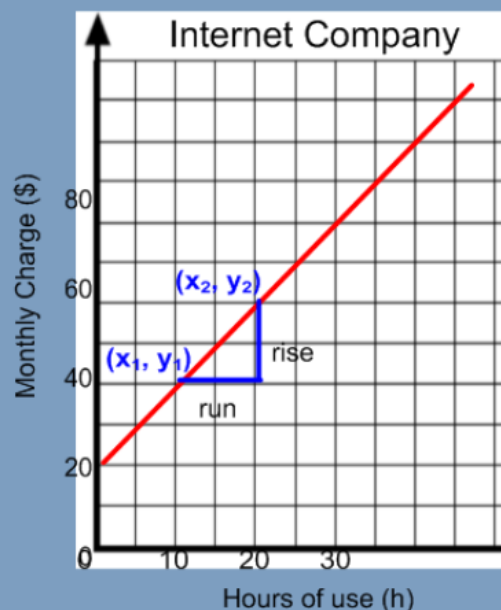
### Focus G: Page 117

Suppose you were only given a graph representing an Internet company and you had to decide if this company was going to work for you. What information could you gain?

- To find the **hourly rate** (charge/hour), we would find the **slope (m)**:

$$\text{rise} = \frac{y_2 - y_1}{x_2 - x_1}$$

- To find the **initial (base) rate**, find the **y-intercept (b)**



Nov 9-1:34 PM

Investigation 5 Pg. 118-119  
 Answer A, B, C  
 #1-4

(A)  $y = mx + b$   $m = \text{slope}$   
 $b = y\text{-int.}$

Company 1 (12, 45) (0, 10)  
 $m = \frac{y_2 - y_1}{x_2 - x_1}$   $m = \frac{45 - 10}{12 - 0} = \frac{35}{12}$   $m = 2.9$   
 $y = 2.9x + 10$

(B) Company 2 (0, 20) (10, 35)  
 $m = \frac{35 - 20}{10 - 0} = \frac{15}{10}$   $m = 1.5$   
 $y = 1.5x + 20$

(C) Company 3 (2, 20) (8, 35)  
 $m = \frac{35 - 20}{8 - 2} = \frac{15}{6}$   $m = 2.5$   
 $y = 2.5x + 15$

Domain  $\{x \mid x \geq 0, x \in \mathbb{R}\}$

Range  $\{y \mid y \geq 15, y \in \mathbb{R}\}$

Nov 16-10:23 PM

**Example:** To deliver soil, Tip Top Soil has a fixed charge plus a charge per "yard" of soil as shown in the graph:

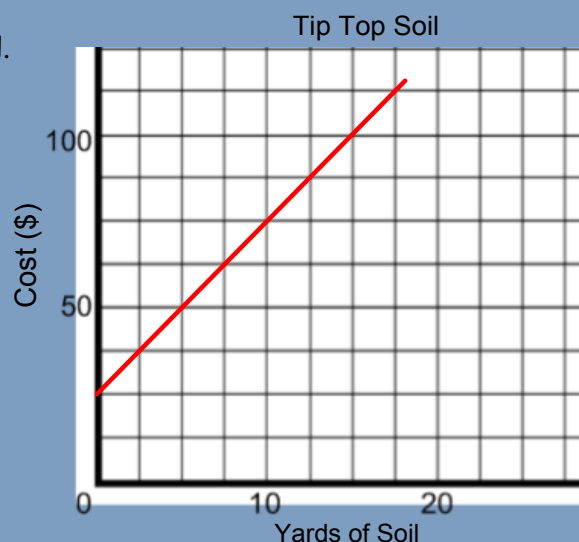
a) Write an equation for the cost to deliver soil.

Use the slope y-intercept form:

$(y = mx + b)$  or  $(y = b + mx)$

Remember you will need:

- Slope (m) (cost/yard)
- y-intercept (b)

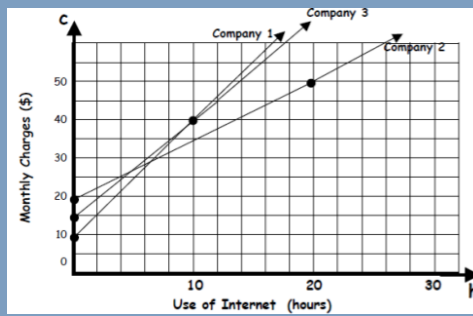


b) How many yards of soil can you purchase for \$125.00?

Nov 11-11:43 AM

### Investigation #5 - Page 119

The rates for 3 Internet companies are shown on the graph below:



Fill in the chart below to write an equation for the monthly rate for each Internet company:

|           | y-intercept<br>(c-intercept) | slope | Equation in<br>(Standard Form) | Equation of<br>Graph |
|-----------|------------------------------|-------|--------------------------------|----------------------|
| Company 1 |                              |       |                                |                      |
| Company 2 |                              |       |                                |                      |
| Company 3 |                              |       |                                |                      |

Nov 11-1:45 PM

Company 1:  $c = 3h + 10$

Company 2:  $c = 20 + 1.5h$

Company 3:  $c = 15 + 2.5h$

1. Suppose you have \$50.00 per month to spend. Which company would you go with?

2. You can read any two points on a graph to find out the hourly cost for a length of time. Find the average hourly cost of Company 2.

Nov 11-2:11 PM

#1

$$50 = 2.9x + 10$$

-10

-10

$$\frac{40}{2.9} = \frac{2.9x}{2.9} \quad x = 13.8$$

C#1  $\rightarrow$  13.8 hrs

$$50 = 1.5x + 20$$

-20

-20

$$\frac{30}{1.5} = \frac{1.5x}{1.5} \quad x = 20$$

C#2  $\rightarrow$  20 hrs

$$50 = 2.5x + 15$$

-15

-15

$$\frac{35}{2.5} = \frac{2.5x}{2.5} \quad x = 14 \text{ hrs}$$

I would use Company 2  
because you can get the  
greatest number of hours.

20 hrs.

Nov 17-8:59 AM

Pg. 119 #5

(a) speed: km/hr.

slope =  $\frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{km}}{\text{h}}$ 

$$\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1} \quad \begin{matrix} (0, 100) \\ (10, 1100) \end{matrix}$$

$$m = \frac{1100 - 100}{10 - 0} = \frac{1000}{10}$$

$$m = 100$$

100 km/hr.

The car is going 100 km/hr. for  
the entire trip.

(b) how far? - km  $y$ -int.

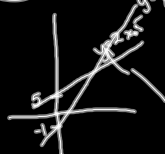
100 km from home.

$$\text{\#6} \quad y = mx + b$$

\text{\#7}

$$\text{\#8} \quad \text{\textcircled{a}} \quad y = 2x + 5 \quad \$2/\text{hr.}$$

\$5



$$y = 2x + 5$$

$$y = 4x - 1$$

Pg. 120-121

#6-12

Nov 17-9:08 AM

## Classwork/Homework

**Pg. 119-121 # 5-12**

Nov 16-10:24 PM

Nov 17-9:08 AM

**ANSWERS**  
Classwork/Homework

Pg. 119-121 # 5-12

- #5 a) To find the speed, you need to find slope  
 $\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$  → You need any two points from the graph

(0,100) and (10,100)

$$m = \frac{100 - 100}{10 - 0} = \frac{0}{10} = 0$$

The speed of the car was 100 km/hr. during the entire trip.

- b) The journey began 100 km from home. We know this because the line begins at 100 on the y-axis. The y-intercept is 100.

c)  $y = mx + b$  Fill in the values from "a" and "b".  
 $y = 0x + 100$

- #6 a) Her weekly earnings does not depend on her sales, it only depends on the number of hours she works.

- b)  $y = mx + b$  We need to find m (the slope) and b (the y-intercept)

$m = \frac{y_2 - y_1}{x_2 - x_1}$  → We need 2 points from the graph:  
 (0,0) and (5,40)

$$m = \frac{40 - 0}{5 - 0} = \frac{40}{5} = 8 \quad m = 8$$

"b" is the y-intercept (where the line crosses the y-axis)

$$b = 0$$

Equation is  $y = 8x + 0$  or  $y = 8x$

- #7 a) To find out how much it costs to print each copy, we need to find the slope.

$\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$  → We need 2 points  
 (0,600) (100,800)

$$m = \frac{800 - 600}{100 - 0} = \frac{200}{100} = \frac{2}{1} = 2 \quad m = 2$$

It costs \$2.00 per copy or 50¢ per copy.

Nov 17-9:08 AM

- #7b. To find the cost to set up the printing equipment we need to find out (from the graph) how much we have to pay at first before making any copies. This is when x would equal zero.

When is "x" zero? At \$600.

This is also the y-intercept.

- c.  $y = mx + b$  Fill in the values from "a" and "b".

$$y = 0.50x + 600$$

(0.5) is the cost and x is the number of copies

- #8 a)  $y = 2x + 5$

-The hourly wage is \$2.00 per hour  
 -The monthly fee is \$5.00.

Sketch:

a-f should have all been done this way.

- "c" and "f" should have negative slopes
  - "g" should have a negative y-intercept.
- You should have noticed that b, c, and f don't make sense as "internet providers".  
 → the internet company is not going to pay you to use their internet.

- #9 \*Can only use #8 equations a, d, and e.

- a) To find out which is better, we need to fill 13 in for "x" in each equation.

|                 |                    |               |
|-----------------|--------------------|---------------|
| $y = 2x + 5$    | $y = 0.5x + 10$    | $y = 15 + x$  |
| $y = 2(13) + 5$ | $y = 0.5(13) + 10$ | $y = 15 + 13$ |
| $y = 26 + 5$    | $y = 6.5 + 10$     | $y = 28.00$   |
| $y = 31.00$     | $y = 16.50$        |               |

I would use the internet provider " $y = 0.5x + 10$ " because it only costs \$16.50

- b) To find out which will give you the most number of hours for \$75.00 we need to fill 75 in for "y" in the equations.

|               |                  |               |
|---------------|------------------|---------------|
| $y = 2x + 5$  | $y = 0.5x + 10$  | $y = 15 + x$  |
| $75 = 2x + 5$ | $75 = 0.5x + 10$ | $75 = 15 + x$ |
| $70 = 2x$     | $65 = 0.5x$      | $x = 60$      |
| $x = 35$      | $x = 130$        |               |
| 35 hours      | 130 hours        | 60 hours      |

Nov 17-9:08 AM

#10 a)  $y = mx + b$  fill the numbers in  
 $y = 3x + 12.5$   
 $\rightarrow \$12.50$  for monthly fee  
 $\rightarrow \$3.00$  per hour of use  
 Do the same for a, b, and c

#11 There are 2 ways to find the answer.

① Interpolating from the graph:  
 $\$115 \rightarrow \#$  of days  
 3 days

② Fill in 115 in for  $y$   
 $y = mx + b$   
 $m = \frac{y_2 - y_1}{x_2 - x_1}$  Need 2 points  
 $\frac{90 - 40}{2 - 0} = \frac{50}{2}$   $m = 25$   
 $y = 25x + 40$   
 $115 = 25x + 40$   
 $-40 \quad -40$   
 $75 = 25x \quad x = 3$   
3 days

#12 To find the hourly cost we need to find the slope  
 $\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1}$  (1, 310)  
 (6, 610)  
 $\frac{610 - 310}{6 - 1} = \frac{300}{5}$   
 $m = 60$   
 The hourly wage is \$60.

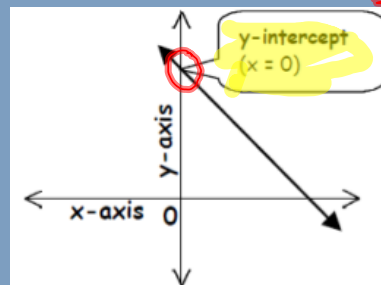
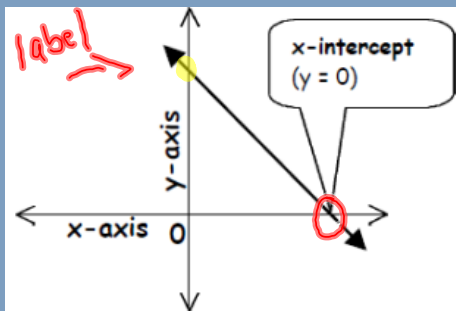
b) 1872.50  $y = mx + b$   
 fill in for  $y$   $y = 60x + 250$   
 $1872.50 = 60x + 250$   $x = 27.42$   
 $1622.50 = 60x$   $\approx 27.50$  hours.

Nov 18-2:20 PM

## X and Y Intercepts:

**X-intercept** = the point where a <sup>(line)</sup> graph crosses the x-axis;  
 the point where  $y = 0$ \*

**y-intercept** = the point where a <sup>(line)</sup> graph crosses the y-axis;  
 the point where  $x = 0$ \*



Nov 2-11:47 AM

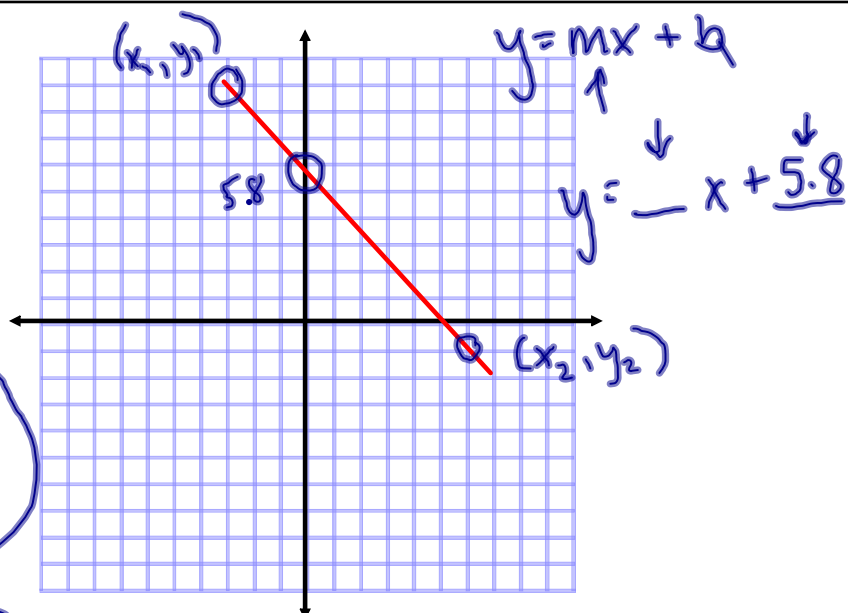
Intercepts:

slope (m)

y-int.

$$\frac{y_2 - y_1}{x_2 - x_1}$$

↪ 2



Nov 14-12:01 PM

## How to Find The X & Y Intercept:

Determine the x-intercept for  $2x + y = 8$ .

Solution:

$$\text{Let } y = 0 \rightarrow 2x + (0) = 8$$

$$\text{Solve for } x \rightarrow 2x = 8$$

$$x = 4$$

x-intercept is  $\rightarrow 4$  or  $(4, 0)$

Determine the y-intercept for  $2x + y = 8$ .

Solution:

$$\text{Let } x = 0 \rightarrow 2(0) + y = 8$$

$$\text{Solve for } y \rightarrow y = 8$$

y-intercept is  $\rightarrow 8$  or  $(0, 8)$

Nov 9-11:55 AM



## Practice:

Find the x and y intercept for the following equations & write them in  $y=mx+b$  form and find the intercepts (x and y):

1.  $3x + y = 9$

3.  $\frac{3}{4}x + y = 8$

2.  $5x + y = 20$

How would you graph  $y = 2x + 5$ ?

| x | y = 2x + 5 | y  |
|---|------------|----|
| 1 | 2(1) + 5   | 7  |
| 2 | 2(2) + 5   | 9  |
| 3 | 2(3) + 5   | 11 |

Points: (1,7), (2,9), (3,11)

Graphing steps:  
 $-2x + y = 5$   
 $+2x$   
 $\rightarrow y = 2x + 5$

Nov 9-12:11 PM

## Classwork/Homework

Copy & Complete

Please take out your homework.

1. Rearrange the equations into the form  $y=mx+b$ :

- a.  $2x + 3y = 6$       b.  $4x + 3y = 12$   
 c.  $3x + y = 9$       d.  $x + 4y = 8$

(these questions came from the yellow text Pg.111#1)

2. Find the x and y-intercepts

- a.  $4x + 5y = 20$       b.  $3x - 4y = 12$   
 c.  $2x + y = 4$       d.  $5x + 3y = 15$

(these questions came from the yellow text Pg.111#2)

3. Create a table of values (at least 3 points) and graph:

- a.  $2x + y = 7$       b.  $3x + y = 4$   
 c.  $4x + y + 4 = 0$       d.  $2x - y = 5$

(these questions came from the yellow text Pg.110 #7)

$y = mx + b$

$\textcircled{2x} + 3y = 6$   
 $-2x$        $-2x$

$3y = \frac{-2x + 6}{3}$

$y = -\frac{2}{3}x + 2$

Nov 17-9:48 PM

Answers

1. a.  $y = -\frac{2}{3}x + 2$   
 b.  $y = -\frac{4}{3}x + 4$   
 c.  $y = -3x + 9$   
 d.  $y = -\frac{1}{4}x + 2$   $y = -\frac{x}{4} + 2$

---

2. x-int. ( $y=0$ ) | y-int. ( $x=0$ )

a.  $4x + 5y = 20$  |  $4x + 5y = 20$   
 $4x + 5(0) = 20$  |  $4(0) + 5y = 20$   
 $4x = 20$  |  $5y = 20$   
 $x = 5$  |  $y = 4$   
x-int. = (5, 0) | y-int. = (0, 4)

b. x-int. = (4, 0) | y-int. = (0, -3)  
 c. x-int. = (2, 0) | y-int. = (0, 3)  
 d. x-int. = (3, 0) | y-int. = (0, 5)

---

3. a)  $2x + y = 7 \Rightarrow y = -2x + 7$

| x | y = -2x + 7 | y |        |
|---|-------------|---|--------|
| 1 | -2(1) + 7   | 5 | (1, 5) |
| 2 | -2(2) + 7   | 3 | (2, 3) |
| 3 | -2(3) + 7   | 1 | (3, 1) |

y-int.  $\Rightarrow (0, 7)$

Nov 19-8:56 AM

## Equation of a Line:

$$y = mx + b$$

(Standard Form)

Slope

y-intercept

COPY

To find the equation of a line you need to determine:

1. a slope
2. a point on the line

Nov 9-11:54 AM

# How to Write The Equation of a Line:

7 Possible Situations that may be presented:

$$y = mx + b$$

- ✓ 1. Given the <sup>m</sup>slope and <sup>b</sup>y-intercept
2. Given two points on the line
- ✓ 3. Given the graph of the line
4. Given the y-intercept and a point on the line
5. Given the x-intercept and a point on the line
6. Given the x-intercept and the y-intercept of the line
7. Given the slope and a point on the line

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## Situation #1: Given the slope and the y-intercept

| STEPS  | EXAMPLE  |
|--|--|
|  | Find the equation of a line that,<br>has a slope of -2 and a y-intercept of 4. |
| A) Substitute the slope and y-intercept into the formula, $y = mx + b$ . | A) $m = -2, b = 4 \rightarrow y = -2x + 4$                                     |

### Practice:

Write the equation of a line in standard form for the following:

1. slope = 5                      y-intercept = -4

$$y = 5x - 4$$

2. slope = -2/3                      y-intercept = 2

Nov 9-1:16 PM

## Situation #2: Given two points on the line

| STEPS   | EXAMPLE   |   |   |                               |              |                     |                     |
|---|---|---|---|-------------------------------|--------------|---------------------|---------------------|
|   | Find the equation of a line that, passes through points $(-1, 6)$ & $(1, 10)$   |   |   |                               |              |                     |                     |
| A) Determine the slope (m).   | <p>A) two points <math>\rightarrow (-1, 6)</math> &amp; <math>(1, 10)</math></p> <p><i>Handwritten: <math>m = \frac{\text{Rise}}{\text{Run}} = \frac{\Delta y}{\Delta x}</math></i></p> $\frac{y_2 - y_1}{x_2 - x_1} = \frac{10 - 6}{1 - (-1)}$ $= \frac{4}{1 + 1}$ $= \frac{4}{2} = 2$ <p>slope (m) = 2</p>  |   |   |                               |              |                     |                     |
| B) Substitute a point on the line and the slope into the formula, $y = mx + b$            | <p>B)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Point <math>(-1, 6)</math> &amp; <math>m = 2</math></td> <td style="width: 50%;">OR Point <math>(1, 10)</math> &amp; <math>m = 2</math></td> </tr> <tr> <td><math>y = mx + b</math></td> <td><math>y = mx + b</math></td> </tr> <tr> <td><math>(6) = (2)(-1) + b</math></td> <td><math>(10) = (2)(1) + b</math></td> </tr> </table> | Point $(-1, 6)$ & $m = 2$   | OR Point $(1, 10)$ & $m = 2$  | $y = mx + b$                  | $y = mx + b$ | $(6) = (2)(-1) + b$ | $(10) = (2)(1) + b$ |
| Point $(-1, 6)$ & $m = 2$   | OR Point $(1, 10)$ & $m = 2$  |   |   |                               |              |                     |                     |
| $y = mx + b$  | $y = mx + b$  |   |   |                               |              |                     |                     |
| $(6) = (2)(-1) + b$   | $(10) = (2)(1) + b$   |   |   |                               |              |                     |                     |
| C) Solve for the y-intercept (b)  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"> <p>C) <math>6 = -2 + b</math></p> <p><math>6 + 2 = b</math></p> <p><math>8 = b</math></p> </td> <td style="width: 50%;"> <p><math>10 = 2 + b</math></p> <p><math>10 - 2 = b</math></p> <p><math>8 = b</math></p> </td> </tr> <tr> <td colspan="2" style="text-align: center;">y-intercept (b) = 8 or (0, 8)</td> </tr> </table>              | <p>C) <math>6 = -2 + b</math></p> <p><math>6 + 2 = b</math></p> <p><math>8 = b</math></p> | <p><math>10 = 2 + b</math></p> <p><math>10 - 2 = b</math></p> <p><math>8 = b</math></p> | y-intercept (b) = 8 or (0, 8) |              |                     |                     |
| <p>C) <math>6 = -2 + b</math></p> <p><math>6 + 2 = b</math></p> <p><math>8 = b</math></p> | <p><math>10 = 2 + b</math></p> <p><math>10 - 2 = b</math></p> <p><math>8 = b</math></p>   |   |   |                               |              |                     |                     |
| y-intercept (b) = 8 or (0, 8)   |   |   |   |                               |              |                     |                     |
| D) Substitute the slope (m) and y-intercept into the formula, $y = mx + b$ ,              | D) $m = 2, b = 8 \rightarrow y = 2x + 8$  |   |   |                               |              |                     |                     |

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*Handwritten:*  $y = mx + b$   
 $\uparrow \quad \quad \uparrow$

## Practice:

Write the equation of a line in standard form for the following:

1.  $(2, 6)$   $(-2, -2)$       2.  $(2, 3)$   $(-1, -3)$

*Handwritten for problem 1:*

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - (-2)}{2 - (-2)}$$

$$= \frac{8}{4} = 2$$

*Handwritten:*  $m = 2$

*Handwritten:*  $y = 2x + 2$

*Handwritten:*

$$y = 2x + b$$

$$6 = 2(2) + b$$

$$6 = 4 + b$$

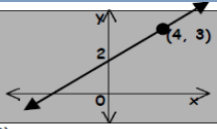
$$-4 \quad -4$$

*Handwritten:*  $2 = b$

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### Situation #3: Given the Graph of the Line

- You need any 2 points to find slope ( $m$ )
  - Find out where the line crosses the y-axis, this is your y-intercept ( $b$ )
- Fill in  $y = \underset{\uparrow}{m}x + \underset{\uparrow}{b}$

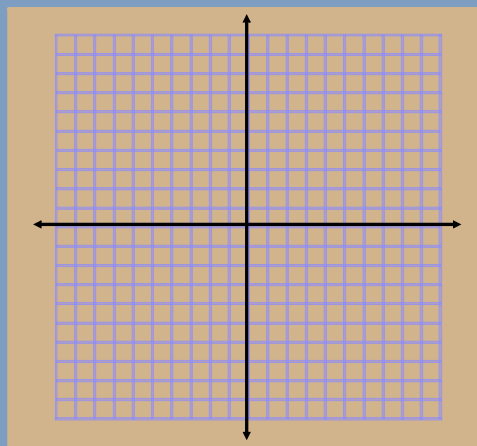
| STEPS  | EXAMPLE   |
|--|---|
|  | Find the equation of a line with the graph →  |
| A) Determine the y-intercept ( $b$ ) by viewing the graph.   | A) y-intercept = 2 or (0, 2)  |
| B) Substitute the y-intercept ( $b$ ) and a point on the line ( $x, y$ ) into the formula $y = mx + b$ . | B) $b = 2$ , point (4, 3) → $(3) = m(4) + (2)$  |
| C) Solve the equation for the slope ( $m$ ).   | C) $3 = 4m + 2$<br>$3 - 2 = 4m$<br>$1 = 4m$<br>$\frac{1}{4} = m$<br><br>slope ( $m$ ) = $\frac{1}{4}$                           |
| D) Substitute the slope ( $m$ ) and y-intercept ( $b$ ) into the formula, $y = mx + b$ ,                 | D) $m = \frac{1}{4}$ , $b = 2$ → $y = \frac{1}{4}x + 2$   |

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### How do we graph an equation of a line in standard form?

- graph the co-ordinate that represents the y-intercept.  
 $y = mx + b$  ← y-intercept
- graph another point by following the slope from the y-intercept.

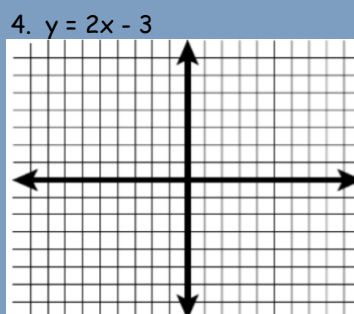
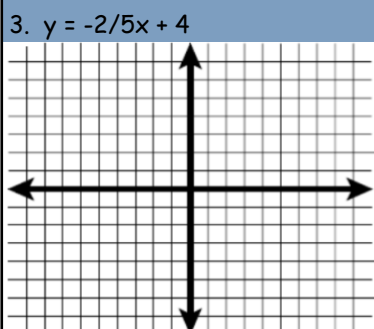
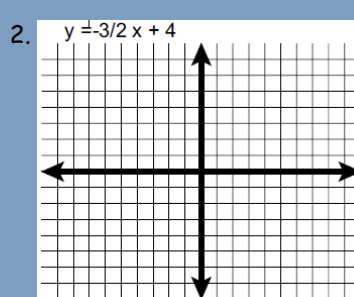
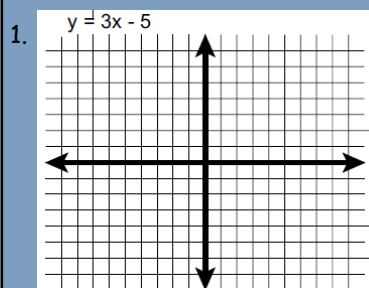
**Example:** graph the linear equation  $y = \frac{-2x + 2}{3}$



Nov 9-2:02 PM

## Practice:

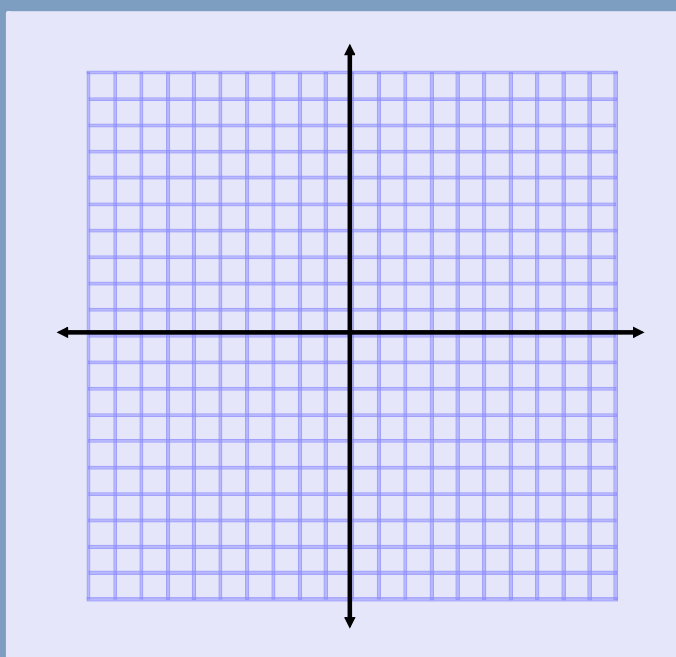
Graph the following:



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What if we had to graph a linear equation?

**Example:** Graph  $y = 2x + 3$



Nov 11-1:45 PM

## Class work / Homework

Complete the assignment labeled:

3.4 Review Assignment.doc

due Tuesday Nov. 25

Nov 9-2:20 PM

**Situation #4:**  
Given the y-intercept and a point on the Line

| STEPS  | EXAMPLE   |
|--|---|
| A) Substitute the y-intercept (b) and the point on the line (x, y) into the formula $y = mx + b$ . | A) $b = -3$ , point $(3, 4) \rightarrow (4) = m(3) + (-3)$<br>$4 = 3m - 3$    |
| B) Solve the equation for the slope (m).   | B) $4 = 3m - 3$<br>$4 + 3 = 3m$<br>$7 = 3m$<br>$7/3 = m$<br>slope (m) = $7/3$ |
| C) Substitute the slope (m) and y-intercept (b) into the formula, $y = mx + b$ ,                   | C) $m = 7/3$ , $b = -3 \rightarrow y = \frac{7}{3}x - 3$                      |

Handwritten notes and calculations:

$y = mx + b$

Points:  $(0, -3)$  and  $(3, 4)$

Slope calculation:

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-3)}{3 - 0} = \frac{7}{3}$$

Equation of the line:

$$y = mx - 3$$

$$y = \frac{7}{3}x - 3$$

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# Practice:

1. y-intercept 5 ; point (3, -4)

(0, 5) (3, -4)

$$\frac{5 - (-4)}{0 - 3} = \frac{9}{-3} \quad m = -3$$

$$y = mx + b$$

$$y = -3x + 5$$

2. y-intercept -3 ; point (1, 1)

$$y = mx + b$$

$$-4 = m(3) + 5$$

$$-4 = 3m + 5$$

$$-9 = 3m$$

$$-3 = m \quad (m = -3)$$

$$y = -3x + 5$$

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## Situation #5:

Given the x-intercept and a point on the Line

| STEPS  | EXAMPLE  |
|--|--|
| A) Change the x-intercept to (x, y) form.  | A) x-intercept of 2 → point (2, 0)   |
| B) Determine the slope (m).  | B) two points → (2, 0) & (6, 2)<br>$m = \frac{RISE}{RUN} = \frac{\Delta y}{\Delta x}$ $= \frac{2-0}{6-2} \quad OR \quad = \frac{0-2}{2-6}$ $= \frac{2}{4} \quad OR \quad = \frac{-2}{-4}$ $= \frac{1}{2} \quad OR \quad = \frac{1}{2}$ <p>slope (m) = <math>\frac{1}{2}</math></p> |
| C) Substitute a point on the line and the slope into the formula, $y = mx + b$   | C) Point (2, 0) & $m = 1/2$<br>$y = mx + b$ $(0) = \frac{1}{2} \left( \frac{2}{1} \right) + b$   |
| D) Solve for the y-intercept (b)   | D) $0 = \frac{2}{2} + b$<br>$0 = 1 + b$<br>$-1 = b$<br><p>y-intercept (b) = -1 or (0, -1)</p>  |
| E) Substitute the slope (m) and y-intercept (b) into the formula, $y = mx + b$ , | E) $m = \frac{1}{2}$ , $b = -1 \rightarrow y = \frac{1}{2}x - 1$   |

Nov 9-1:16 PM



| TEPS | EXAMPLE  |
|------|--|
|      | Find the equation of a line that, has an x-intercept of 2 and passes through (6, 2). |

① x-intercept is 2  $\rightarrow$  (2, 0)

Now, we have 2 points: (2, 0) and (6, 2)

② Find slope (m)  $\Rightarrow \frac{2-0}{6-2} = \frac{2}{4} \quad m = \frac{1}{2}$

③ Find the y-intercept

Fill in:  $y = mx + b$

$2 = \left(\frac{1}{2}\right)(6) + b$

$2 = 3 + b$

$-3 \quad -3$

$-1 = b$

So,  $y = mx + b$ ,  $y = \frac{1}{2}x - 1$

(6, 2)  $\begin{matrix} x=6 \\ y=2 \\ m=\frac{1}{2} \end{matrix}$

Nov 24-11:59 AM

## Practice:

1. x-intercept = 5 ; point (-2, 5)

2. x-intercept = -3 ; point (1, 1)

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$$y = mx + b$$

### Situation #6:

Given the x-intercept and y-intercept of the Line

This is done the same as if you were given two points on the line. Convert the x and y-intercepts to (x, y) form and follow the same procedure when given two points on the line.

|   |  |
|---|--|
| STEPS: $y = mx + 3$   | Example:<br>y - intercept = 3 ; x - intercept = -2                                     |
| A) Change both intercepts into points.                                      | y-intercept = 3<br>(0, 3)<br>x-intercept = -2<br>(-2, 0)                               |
| B) Find the slope   | $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 3}{-2 - 0} = \frac{-3}{-2} = \frac{3}{2}$ |
| C) Substitute the slope and a point into the equation<br>$y = mx + b$ .     | $y = mx + b$<br>$y = \frac{3}{2}x + 3$   |
| D) Solve for b.   |  |
| E) Substitute the slope and y-intercept into the equation<br>$y = mx + b$ . |  |

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### Situation #7:

Given the slope and a point on the Line

|   |   |
|---|---|
| STEPS<br>$y = mx + b$<br>$y = 4x + b$   | EXAMPLE<br>Find the equation of a line that,<br>has a <u>slope of 4</u> and passes through (5, 1) |
| A) Substitute the slope (m) and the point on the line (x, y) into the formula<br>$y = mx + b$ . | A) $m = 4$ , point (5, 1) → $(1) = (4)(5) + b$  |
| C) Solve the equation for the y-intercept (b).  | C) $1 = 20 + b$<br>$1 - 20 = b$<br>$-19 = b$<br><br>y-intercept (b) = -19                         |
| D) Substitute the y-intercept (b) and slope (m) into the formula,<br>$y = mx + b$ ,             | D) $m = 4$ , $b = -19$ → $y = 4x - 19$  |

Nov 11-12:44 PM

## Practice:

1. slope =  $-\frac{1}{3}$  ; point (1, -1)

$$y = mx + b \quad \begin{matrix} x=1 \\ y=-1 \end{matrix}$$

$$y = -\frac{1}{3}x + b$$

$$-1 = -\frac{1}{3}(1) + b$$

$$3(-1) = \left(-\frac{1}{3} + b\right) 3$$

$$-3 = -\frac{3}{3} + 3b$$

$$-3 = -1 + 3b$$

$$-2 = \frac{3b}{3} \quad b = -\frac{2}{3}$$

$$y = -\frac{1}{3}x - \frac{2}{3}$$

Nov 11-1:08 PM

Equation of a line is:  $y = mx + b$

- slope = m
- y-intercept = b

Questions:

1. How are we going to find the slope?
2. How are we going to find the y-intercept?

① One way is using 2 points  $\left(\frac{y_2 - y_1}{x_2 - x_1}\right)$

② Filling in the slope and a point into  $y = mx + b$   
 - solve for b  
 - from a graph - where the line crosses the y-axis.

$$\textcircled{1} m = \frac{y_2 - y_1}{x_2 - x_1} \quad \textcircled{2} y = mx + b$$

Write your answer as

$$y = mx + b$$

$\uparrow$                        $\uparrow$   
 slope                  y-int

Nov 19-12:03 PM

## Class work / Homework

Complete the following:

{ Questions Pg.123 #15,16  $y=mx+b$  2 points  
 Questions Page 125 # 21,22bc,25

#15. a)  $y=4x-5$  The y-int is -5 and the line has a slope of 4.

b)  $y=-5x+2$

c)  $y=2+7x$

Alike

- b and c have the same y-int (+2)
- a and c both have positive slopes

Different

#16.  $\frac{2}{3}$  or  $-\frac{5}{6}$   
 $\left(\frac{4}{6}\right)$

Nov 11-12:37 PM

## Answers

Pg.123 #15,16

#15) Alike? - all have a slope and y-int.  
 - b and c have a y-int. of 2  
 - a and c both have positive slopes.

Different? - all slopes are different  
 - b has a neg. slope  
 - c is not in the form  $y=mx+b$

#16) Steeper?  $\frac{2}{3}$  or  $-\frac{5}{6}$   $\frac{2}{3} = \frac{4}{6}$

$-\frac{5}{6}$  is steeper because  $\frac{4}{6}$  is less

than  $\frac{5}{6}$

It doesn't matter if one is neg.

Nov 26-8:55 AM

Answers

#21) a)  $(2, 5)$   $m=4$   $y=4x+b$   
 $5=4(2)+b$   
 $5=8+b$   
 $-8 -8$   
 $-3=b$   
 $y=4x-3$

b)  $(-3, 1)$   $m=0$   $y=0x+b$   
 $1=0(-3)+b$   
 $1=0+b$   
 $1=b$   
 $y=1$

c)  $x=inf=4$   $m=\frac{3}{4}=0.75$   $y=0.75x+b$   
 $(4, 0)$   $0=0.75(4)+b$   
 $0=3+b$   
 $-3 -3$   
 $-3=b$   
 $y=\frac{3}{4}x-3$

d)  $y=inf=5$   $m=-\frac{1}{3}$   $y=-\frac{1}{3}x+b$   
 $y=-\frac{1}{3}x+5$

e)  $x=inf=2$   $y=inf=-3$   $y=\frac{3}{2}x-3$   
 $(2, 0)$   $(0, -3)$   
 $m=\frac{y_2-y_1}{x_2-x_1}=\frac{-3-0}{0-2}=\frac{-3}{-2}=\frac{3}{2}$   
 $y=\frac{3}{2}x-3$

#22b)

b)  $(-3, 5)$   $(1, -2)$   $y=mx+b$   
 $m=\frac{5-(-2)}{-3-1}=\frac{7}{-4}=-\frac{7}{4}$   $m=-\frac{7}{4}$   
 $y=-\frac{7}{4}x+b$   
 $5=-\frac{7}{4}(-3)+b$   $y=-\frac{7}{4}x-\frac{1}{4}$   
 $5=\frac{21}{4}+b$   
 $5=\frac{21}{4}+\frac{b}{1}$   
 $-5.25 -5.25$   
 $-0.25=b$   $b=-\frac{1}{4}$

Nov 25-2:01 PM

22. b)  $y=-\frac{7}{4}x-\frac{1}{4}$

c)  $(2) = (-\frac{7}{4}x - \frac{1}{4})$   
 $48 = -\frac{7}{4}x - \frac{1}{4}$   
 $48 = -\frac{7}{4}x - \frac{1}{4}$   
 $+1 +1$   
 $\frac{49}{4} = -\frac{7}{4}x$   $x=-7$

#25)  $(\$6000, \$630)$   
 $(\$8000, \$790)$

a)  $y=mx+b$   $m=\frac{790-630}{8000-6000}$   
 $y=0.08x+b$   $m=\frac{160}{2000}$   
 $630=0.08(6000)+b$   $m=0.08$   
 $630=480+b$   
 $-480 -480$   
 $b=150$   $y=0.08x+150$

d)  $y=0.08(12000)+150$   
 $y=960+150$   
 $y=1110$   
 $\$1110$

e)  $950=0.08x+150$   
 $-150 -150$   
 $800=0.08x$   $x=10000$   
 $\frac{800}{0.08} = \frac{0.08x}{0.08}$   $\$10000$

Nov 26-9:28 AM

Pg. 127 #28, 29

Nov 26-8:55 AM

Rearranging Equations Pg. 128, 129

Example #1:

$$3x + 2y - 12 = 0$$

$$\begin{array}{r} 3x + 2y - 12 = 0 \\ -3x \phantom{+ 2y - 12} \\ \hline 2y - 12 = -3x \\ +12 \phantom{+ 2y - 12} \\ \hline 2y = -3x + 12 \\ \frac{2y}{2} = \frac{-3x + 12}{2} \end{array}$$

$$y = -\frac{3}{2}x + 6$$

Example #2:

$$\frac{A}{w} = \frac{l}{\mu}$$

Solve for  $l$

$$l = \frac{A}{w}$$

Example #3:

$$p = 2l + 2w$$

Solve for  $l$

$$\begin{array}{r} p = 2l + 2w \\ -2w \phantom{+ 2l} \\ \hline p - 2w = 2l \\ \frac{p - 2w}{2} = \frac{2l}{2} \\ l = \frac{p - 2w}{2} \end{array}$$

Example #4:

$$V = \pi r^2 h$$

Solve for  $h$

$$h = \frac{V}{\pi r^2}$$

Example #5:

$$A = \frac{1}{2}bh$$

Solve for  $b$

$$\begin{array}{r} 2A = bh \\ \frac{2A}{h} = \frac{bh}{h} \\ b = \frac{2A}{h} \end{array}$$

Nov 26-8:55 AM

## Classwork / Homework

Answer questions Pg. 129 # 31-35

Nov 26-9:02 AM

### Graphing Linear Equations on a TI-83:

To Check Before we Begin:

1. The axes must be turned on.

This is done by pressing the yellow 2<sup>nd</sup> key, and the the ZOOM key (yellow command is FORMAT).

Highlight Axes On, press ENTER.

```
RectGC PolarGC
CoordOn CoordOff
GridOff GridOn
      AxesOff
LabelOff LabelOn
ExprOn ExprOff
```

2. Plots must be turned off.

This is done by pressing the yellow 2<sup>nd</sup> key, and then the y= key (yellow command is STAT PLOT).

```
STAT PLOTS
1:Plot1...Off
  [ ] L1 L2
2:Plot2...Off
  [ ] L1 L2
3:Plot3...Off
  [ ] L1 L2
4:PlotsOff
```

Highlight 4: PlotsOff, then press ENTER twice.

```
PlotsOff Done
```

Nov 11-2:31 PM

## Now Let's Begin:

There are several points which you should note about graphing linear equations on the TI-83 Plus:

1. The blue  $-$  key indicates the subtraction operation.  
The grey  $(-)$  key indicates a negative number.
2. To enter  $x$  (or any variable), press the key to the right of the ALPHA key.  
It is marked  $X, T, \theta, n$ .
3. To enter a slope such as  $2/3$ , press 2, the divide key, then 3.

1. Press the Y= key. Type in the equation  $y = 2x + 5$ .

```

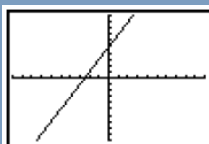
Plot1 Plot2 Plot3
Y1=2X+5
Y2=
Y3=
Y4=
Y5=
Y6=
Y7=
    
```

2. Press ZOOM.  
Highlight 6:ZStandard.

```

ZOOM MEMORY
1:ZBox
2:ZBox In
3:ZBox Out
4:ZDecimal
5:ZSquare
6:ZStandard
7:ZTrig
    
```

3. Press GRAPH.



Nov 11-2:36 PM

## Focus H: Understanding slope better page 122

A student borrowed \$490 to buy a stereo. She agreed to repay the loan at \$35.00 per month. Write an equation to represent this line.

Need 2 things:

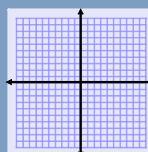
- $y$ -intercept =
- slope =

Equation of the line:

Sketch what would the graph look like?

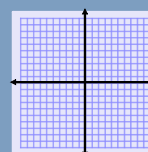
### Focus Questions:

13. The graph of  $y = 5$  is a horizontal line.  
a) show the line on a grid.



- b) what is the  $y$ -intercept? How do you know?
- c) Explain why this graph has a slope of zero.

14. The graph of  $x = 5$  is a vertical line.  
a) Show the line on a grid.



- b) What is the  $x$ -intercept? How do you know?
- c) Explain why this graph has a slope that is undefined?

Nov 11-2:33 PM



Class work / Homework

Complete the following:

- Page 123 #'s 15 - 20

Nov 11-3:01 PM

## Attachments

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Sec 3.4 - Slopes.doc

Sec 3.4 - Write the equation of a line (1).doc

3.4 Review Assignment.doc

sec. 3.4 - Write the equation of a line (2).doc